

U.S. DEPARTMENT OF ENERGY
NEVADA OPERATIONS OFFICE

ORDER

NV O 56XH.1A

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**SUBCRITICAL EXPERIMENT (SCE)
SAFETY PROGRAM**



INITIATED BY:
Stockpile Stewardship Division/
Nuclear Explosive Safety

SUBCRITICAL EXPERIMENT (SCE) SAFETY PROGRAM

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1. OBJECTIVES. Establish the DOE Nevada Operations Office (DOE/NV) SCE policy, requirements, standards, criteria, authorities, and responsibilities for the conduct of Subcritical Experiment Operations (SCEO) safety at the Nevada Test Site (NTS). SCE safety issues shall be resolved through a systematic process whereby the concept of operation is totally considered; attendant risks are identified, analyzed, evaluated, and documented; and as a consequence, informed decisions are made at the appropriate management level to ensure that the degree of safety provided is adequate and consistent with overall program objectives.
2. CANCELLATION. NV Order 56XH.1, SCE SAFETY PROGRAM, dated 8-13-98.
3. APPLICABILITY.
 - a. The provisions of this Order applies to DOE/NV organizational elements, DOE/NV contractors, subcontractors, associated agencies, Los Alamos National Laboratory (LANL), and Lawrence Livermore National Laboratory (LLNL) engaged in the preparation and conduct of NTS SCE programs, as provided by law and/or contract, and as implemented by appropriate Contracting Officers.
 - b. The Contractor Requirements Document (Attachment 1) sets forth intended requirements to be implemented by LANL, LLNL, and NTS contractors for SCEOs.
4. REQUIREMENTS.
 - a. SCEOs shall be conducted consistent with DOE P 450.4, SAFETY MANAGEMENT SYSTEM POLICY, dated 10-15-96; and NV P 450.4, NEVADA OPERATIONS OFFICE INTEGRATED SAFETY MANAGEMENT POLICY, dated 9-19-97.
 - b. A Hazards Assessment (HA) shall be conducted for each SCE to include all SCEOs, their associated activities, and facilities. The HA shall identify and categorize potential hazards and identify positive measures which contribute to the SCEO Safety Standards and prevent, mitigate, or minimize each hazard.
 - c. Written procedures shall be developed to govern SCE operations which ensure that delegation of responsibilities and authorities by name are clearly defined, recorded, and published for review by DOE/NV and all personnel participating

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in the DOE/NV SCE Safety Program. All procedures for SCEOs are to be reviewed and approved by the appropriate supervisor prior to execution of those activities.

- d. Procedures and equipment approved for use in high explosives (HE) and/or special nuclear material (SNM) operations shall be subject to periodic review to ensure continued safe operations.
- e. Training and Qualification.
 - (1) Each DOE/NV organizational element responsible for or involved in SCE operations and associated activities shall implement a training and qualification program for their respective employees who perform SCEOs. This training program shall comply with the applicable portions of DOE O 360.1, TRAINING FOR FEDERAL EMPLOYEES (Reference a).
 - (2) General. A training and qualification program shall be developed and implemented for personnel who perform SCEOs. This training program shall include:
 - (a) Requirements for selecting and qualifying personnel.
 - (b) Training consistent with the requirements of DOE Order 5480.20A, PERSONNEL SELECTION, QUALIFICATION, AND TRAINING REQUIREMENTS FOR DOE NUCLEAR FACILITIES, except Chapters II and III (Reactor Operations) (Reference b). Training and qualification requirements shall be commensurate with assigned responsibility.
- f. Training Oversight. The DOE/NV Nuclear Explosive Safety (NES) Program Manager (PM) shall ensure compliance with the training requirements of this Order by conducting periodic appraisals of LLNL, LANL, Management and Operations, and Security contractors training programs employing the NES Staff Program Guide (Reference c).
- g. Personnel Assurance Program (PAP). SCE PAP requirements shall follow those stated in DOE O 452.2A, SAFETY OF NUCLEAR EXPLOSIVE OPERATIONS; 10 Code of Federal Regulations (C.F.R.) Part 711, "Personnel Assurance Program"; and NV O 452.2A, SAFETY OF NUCLEAR EXPLOSIVE OPERATIONS.

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- h. Two-Person Concept for SCEO. The modified two-person concept, as defined in paragraph 6h, shall apply. Procedures shall be developed for the application of the modified two-person concept. Procedures may take any form appropriate for the activity. This might include standard operating procedures, security station orders, K badge, etc. A list of PAP certified personnel authorized for two-person concept shall be developed, kept at the appropriate guard station, and displayed at each SCE operational area.
- i. SCE Safety Standards and General Rules. For HE/SNM operations, SNM dispersal is recognized as one of the potential hazards of an SCEO. Hazard prevention and mitigation is addressed in the HA and must be in place prior to the SCEO. Compliance with the general safety rules, hazard preventers, mitigators, and the two SCE safety standards will minimize the possibility of SNM dispersal. The safety standards listed below are patterned after the safety standards promulgated in the orders for safety of nuclear explosive operations.
 - (1) SCEO Safety Standards. The SCEO shall meet the following qualitative safety standards to protect against unintended HE detonation, HE deflagration, or SNM dispersal. There shall be positive measures to:
 - (a) Minimize the possibility of accidents, inadvertent acts, or authorized activities that could lead to unintended HE detonation, HE deflagration, or SNM dispersal.
 - (b) Minimize the possibility of HE detonation, HE deflagration, or SNM dispersal given accidents or inadvertent acts.
 - (2) General SCE Safety Rules. The safety rules set forth in this section are patterned after the general NES rules and are mandatory for SCEOs conducted at the NTS.
 - (a) No SCEO shall be conducted until a specific safety evaluation has been performed and approved by the DOE/NV Manager.
 - (b) SCEOs involving HE and/or SNM shall be conducted in accordance with approved written procedures.

NOTE: The security station Orders used for nuclear explosive operations shall be used during SCEOs. These Orders are required

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to have reviews and concurrence by design laboratory personnel who have been delegated NES responsibility. A review for NES concerns shall satisfy SCE safety concerns and does not require a separate review of the same procedures.

- (c) Electrical test instruments used for HE detonator or squib circuit measurements shall be evaluated by the Safety Evaluation Panel (SEP), identified in the SEP Report, and approved by the Manager. These electrical test instruments shall be current--limited to a safe value consistent with the detonator or squib being examined. Use on subsequent SCEOs will not require instrument reevaluation by the SEP, merely verification that the new application falls within the instrument's safe operational envelope. Instrument use shall comply with the requirements specified in DOE/NV document Subcritical Electrical Safety Program, Electrical Tester Criteria (Attachment 2).
- (d) Vehicles transporting HE and/or SNM for an SCE on the NTS shall travel at reasonable and proper speeds appropriate for road and weather conditions, but not exceed 45 miles per hour.
- (e) Concurrent HE operations, including but not limited to assembly, disassembly, storage, or transportation, whose detonation would adversely affect the SCE SNM and/or HE configuration, and which have not been evaluated by the SEP, are not allowed.
- j. Control of Electrical Testers and Equipment. The criteria and standards established by the DOE/NV document Subcritical Electrical Safety Program, Electrical Tester Criteria (Attachment 2) shall apply to all SCEOs.
- k. SCEO Safety Evaluations. A SCE SEP shall be established by the Manager to evaluate the proposed operations associated with each SCE. The panel shall provide a report to the Manager with their recommendation of whether or not the proposed operations can be conducted safely. This process shall take place prior to beginning any SCE operation.
 - (1) Safety Evaluation Scope.
 - (a) An input document shall be prepared for the SEP's use. This information shall contain an assessment of the hazards associated

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with operations, including both normal and abnormal environments, and identify potentially credible accidents and incidents based on the severity of the occurrence and associated mitigators.

- (b) Briefings of the proposed SCE operations shall be prepared for presentation to the SEP. The briefings are to present the input document and any additional information that would be necessary for the SEP to adequately review and ensure the Manager that operations will meet the standards and other criteria established by this Order.
 - (c) The SCE SEP shall consider and evaluate the information provided in the input document and technical briefings and other criteria as defined by the laboratory test director.
 - (d) Questions concerning the adequacy of the input document shall be directed to the SEP chairperson for resolution.
- (2) The DOE/NV Manager designates, in writing, the chairperson for each SCE SEP. The chairperson, after consultation with either LANL or LLNL, shall:
- (a) Determine the time and location of the SEP meeting and ensure coordination with DOE/NV and laboratory schedules.
 - (b) Ensure that the input document is available to the SEP normally 4 weeks prior to the safety evaluation, or as may be appropriate for the scheduled evaluation.
 - (c) Request members from LANL, LLNL, the DOE/NV Environment, Safety & Health Division (ESHD), and the DOE/NV NES Staff. Additional panel members and advisors may be appointed by the chairperson, as appropriate. The panel members are to be certified, in writing, by their respective organizations as to their individual training and experience appropriate to the SEP activity.
 - (d) Determine the SCE input document includes as a minimum:
 - 1 The SCEO HA as specified in paragraph 4b.

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- 2 A description of the proposed SCEOs with applicable technical data.
- 3 A description of the SCE and the facilities, equipment, and procedures utilized in conjunction with HE and/or SNM to determine:
 - a Any potential threat to the HE.
 - b Effect on criticality safety.
 - c Potential for SNM dispersal.
- 4 A discussion of the criticality safety of the proposed operations.
- 5 The application of the two-person concept, as required.
- 6 A table of organizations and/or administration that delineate, by name, responsibilities at all operating levels.
- 7 An electrical tester description by make and model.
- 8 Description of any special tooling used in conjunction with HE and/or SNM.
- 9 A summary of written procedures for the receipt, storage, handling, and transport of HE and/or SNM.
- 10 A description of the arming, timing, and firing system to include administrative and engineered measures as they relate to safety.
- 11 Information affirming that the proposed experiment shall be conducted within the parameters of the DOE/NV NTS environmental impact statement (Reference d).
- 12 Information affirming that the HA for the proposed experiment has been coordinated with the Emergency Management Hazards Assessment (EMHA) for the U1a Complex (Reference e).

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13 The DOE/NV Environment, Safety, Health, and Emergency Management Program requirements have been met for, as a minimum, the activities listed below:

- a Underground safety.
- b Safety of laser operations.
- c Explosive safety.
- d Radiation safety (i.e., general, experiment setup, complex utility reestablishment).
- e Hazardous materials.
- f Training.
- g Fire protection/prevention.
- h Reporting/lessons learned.
- i Cranes, forklifts, and hoists.
- j Emergency response.
- k Industrial hygiene.
- l Electrical safety.
- m Environmental safety.

14 Potential threats to the SCE from security operations.

15 The safety of equipment and procedures involved in SCE transport.

16 An evaluation of any concurrent operations in relation to an SCEO for SNM dispersal or HE detonation or deflagration.

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- I. SCE SEP Report. The panel report, including recommendations, shall be submitted by the DOE/NV Chairperson to the DOE/NV Manager for review and approval. Deviations from the approved operations must be reviewed for their impact on the safety of SCEOs. Deviations which will have an impact on the safety of the SCEOs are to be submitted to DOE/NV SEP Chairman for review and approval. If he judges the deviation significant he may reconvene the entire panel.

- m. SCE SEP Report Format.

The SCE SEP Report format shall consist of the following:

- (1) A cover page with title and date.
- (2) An executive summary or abstract as the next page.
- (3) A table of contents.
- (4) A signature page identifying each panel member and parent organization.

The body of the report shall set forth the following, as required:

- (1) Purpose.
- (2) The criteria used for the evaluation, including any instructions by the DOE/NV Manager.
- (3) Scope defining the proposed operations evaluated by the panel.
- (4) SCE description.
- (5) Panel activities, including time and place of meetings and/or field observations.
- (6) Study participants.
- (7) Analysis, conclusions, and recommendations.
- (8) Safety rules or required actions necessary to conduct an SCE.

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- (9) Any safety concerns which may adversely effect SCE operations, including recommendations.
- (10) A minority report (if any) and the panel majority rebuttal.
- (11) References.
- (12) Appendices, including the input document.
- (13) Attachments as deemed appropriate by the SCE SEP members.
- n. A post SCE safety lessons learned meeting will be conducted by the NES PM and the results documented.
- o. DOE/NV SCEO Safety Oversight. Safety oversight of the SCEOs shall be performed by the appropriate DOE/NV NES and ESHD staff.
 - (1) Field Reviews. Field reviews by the NES PM, or designated representative, will be made at random to verify that the SCE operations are in compliance with the applicable SCEO Orders. All field reviews shall be coordinated with responsible NTS personnel.
 - (2) As-Built Review.
 - (a) DOE/NV NES PM shall convene an SCE SEP issues closure review to ensure that the configuration meets all SCEOs safety requirements, as evaluated by the panel. It shall be the responsibility of the design laboratory (either LLNL or LANL) to coordinate SCE progress with the DOE/NV NES PM to facilitate these reviews.
 - (b) The As-Built review should be conducted at a time deemed appropriate by the SCE SEP chairperson and the laboratory Test Director. In the case where there are SCEOs yet to be performed, a description of these operations will be presented at the review.
 - (c) The panel shall determine, with the responsible design/assembly engineer(s), whether all recommendations have been appropriately closed and if there were significant deviations, which could compromise or degrade the safety of subsequent SCE operations.

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- (d) A single document shall be prepared and signed by the panel members certifying to the DOE/NV Manager that the assembly of the SCE configuration was accomplished with no deviations from the approved assembly plan which unacceptably reduces the SCE safety.
 - (e) Verification of successful completion, together with a description and evaluation of deviations which occurred after formal review will be documented by the sponsoring laboratory in correspondence to the DOE/NV NES PM. This documentation should be prepared as expeditiously as practical and before experiment completion.
- p. Change Control. Change control is maintained by adherence to **DOE/NV NES/SCE--CHANGE CONTROL PROCESS** (Attachment 3).
- 5. RESPONSIBILITIES. Clear and unambiguous lines of authority and responsibility for ensuring safety shall be established and maintained at all organizational levels.
 - a. DOE/NV Manager. Responsible for the safe conduct of the SCE Program. This includes:
 - (1) The designation, in writing, of the DOE/NV Chairperson for the SEP chosen from the NES Staff.
 - (2) Approving or disapproving the SCEO SEP Report and any recommendations. Adjudicating any minority opinions attached to the report.
 - (3) Providing each design laboratory conducting an SCE with a delegation of authority in regard to the safe conduct of the SCE and operational matters supported by DOE/NV NTS contractors.
 - (4) Providing DOE/NV NTS contractors, through letters of delegation, with direction to support design laboratory activities during SCEO.
 - (5) Reviewing qualifications of, and approving, in writing, candidates proposed by the laboratories for their Test Director positions.

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b. NES Program Manager.

- (1) Provides, with the approval of the Manager, a chairperson for each SCE SEP who reports directly to the Manager.
- (2) Ensures that prior to beginning any SCEO at the NTS, where the HE and SNM are collocated, a SEP Report has been submitted, reviewed, and approved.
- (3) Ensures that the SEP Chairman conducts an SCE As-Built Review.
- (4) Ensures the reviews of LLNL or LANL requests for deviation from the approved SEP Report and either provides an administrative approval or recommends to the Manager that the SEP be reconvened to consider the deviation.
- (5) Ensures that one or more field reviews of LLNL, LANL, or NTS contractor SCEO preparations is conducted.
- (6) Ensures that periodic appraisals of LANL and LLNL SCEO safety programs in conjunction with ESHD is conducted.
- (7) Conducts periodic appraisals of NTS DOE/NV Performance-Based Management Contractor and Security Service Contractor SCE training and SCE critical safety equipment maintenance and certification programs.

c. Director, DOE/NV ESHD.

- (1) Provides a member to the SCE Panel.
- (2) Provides oversight in the areas of occupational safety, environmental protection, fire protection, industrial hygiene, occupational medicine, industrial safety, and radiological protection during SCEO.

d. Director, DOE/NV, Emergency Management Division.

- (1) Ensures the U1a Complex, SCE EMHA, Emergency Management Plan, and Emergency Management Implementing Procedures are updated, if required, in concert with the SCE Panel report.

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- (2) Provides emergency management oversight during SCE operations and activates the DOE/NV Emergency Response Organization to manage an operational emergency which occurs during the conduct of an SCE.

6. DEFINITIONS.

- a. Abnormal Environment. Any environment that an SCE configuration is not expected to experience during planned operations.
- b. Access. That proximity to an SCE configuration that affords a person the opportunity to cause an HE detonation or deflagration, and/or the spread of SNM.
- c. Arming. Configuring an SCE in a manner such that a single signal will initiate an HE detonation.
- d. Emergency Management HA. A quantitative analysis of the release or loss of control of hazardous materials (radiological and nonradiological). The EMHA provides the technical basis for facility and SCE emergency plans and implementing procedures.
- e. Hazard Analysis. A process that documents the systematic evaluation of hazards to workers, the public, and the environment for an SCEO and its associated activities, and is used to ascertain that a SCE operation can be conducted safely and in accordance with applicable laws and regulations.
- f. HE Deflagration. A rapid chemical reaction in which the output of heat is sufficient to enable the reaction to proceed and to be accelerated without input of heat from another source. Deflagration is a surface phenomenon, with the reaction products flowing away from the unreacted material at subsonic velocity.
- g. HE Detonation. A violent chemical reaction within a chemical compound or mechanical mixture involving heat and pressure. A detonation is a reaction that proceeds through the reacted material toward the unreacted material at a supersonic velocity.
- h. Modified Two-Person Concept. The traditional two-person concept requires that at no time will only one individual have access to SNM that is collocated with HE. At least two PAP certified, authorized persons must be present who

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have adequate knowledge of the operations to be performed and must be in a position to observe each other, as well as the ongoing operation, at all times. Individuals who are assigned two-person concept responsibilities are required to be so identified until relieved of this responsibility by another authorized, knowledgeable, PAP certified person. This concept shall be implemented for the SCE Program whenever Category I or credible rollup quantities of Category II SNM is present (per DOE Order 5633.3B, CONTROL AND ACCOUNTABILITY OF NUCLEAR MATERIALS, dated 9-7-94). For operations involving Category III or IV quantities, the sponsoring laboratory will apply safety and administrative procedures in accordance with their own and NTS requirements.

- i. Positive Measures. Design features, safety rules, procedures, or other controls used individually or collectively to maximize safety of the SCEO. Positive measures ensure a safe response in abnormal environments and/or maintain a controlled safety posture during SCE operations. Positive, for these purposes, does not mean "absolute."
- j. Safety Critical Equipment. That equipment usually determined by the hazard assessment process to be relied upon for safety to the extent that the failure of that equipment could result in a significant safety vulnerability.
- k. SCE Configuration. A configuration of HE and SNM, subcritical by design, when assembled at the NTS.
- l. SCE Safety Evaluations. A formal DOE/NV process, whereby the safety of the proposed operation is evaluated and documented in an evaluation report.
- m. SCE Safety Rules and Standards. Those requirements that define the conditions, safe boundaries, and management or administrative controls necessary to ensure a safe SCE operation and reduce the potential risk to workers, the public, and the environment.
- n. SNM Dispersal. The aerosolization and dispersal of SNM by a driving force, such as fire, HE deflagration, or HE detonation.
- o. Subcritical. A term applied in this Order to SNM and indicating, under planned operations, the SNM cannot achieve a K effective of one.

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- p. Subcritical Experiment Operations. Activities involving co-located SNM and its associated HE during the conduct of an SCE, including assembly, disassembly, storage, transportation, installation/insertion, arming and firing, and reentry.

7. REFERENCES.

- a. DOE O 360.1, TRAINING, dated 5-31-95.
- b. DOE Order 5480.20A, PERSONNEL SELECTION, QUALIFICATION, AND TRAINING REQUIREMENTS FOR DOE NUCLEAR FACILITIES, dated 11-15-94.
- c. DOE NEVADA OPERATIONS OFFICE NUCLEAR EXPLOSIVE SAFETY (NES) STAFF PROGRAM GUIDE, dated 8-98.
- d. FINAL ENVIRONMENTAL IMPACT STATEMENT FOR THE NEVADA TEST SITE AND OFF-SITE LOCATIONS IN THE STATE OF NEVADA, dated 8-96, DOE/EIS 0243.
- e. EMERGENCY MANAGEMENT HAZARDS SURVEY AND HAZARDS ASSESSMENT FOR U1a COMPLEX, NEVADA TEST SITE, Revision 1, 2-10-98, LANL.
- f. DOE Order 5633.3B, CONTROL AND ACCOUNTABILITY OF NUCLEAR MATERIALS, dated 9-7-94.
- g. 10 C.F.R., Part 711, PAP.

- 8. CONTACT. DOE/NV NES Program Point of Contact, (702) 295-2588.



Kathleen A. Carlson
Manager

CONTRACTOR REQUIREMENTS DOCUMENT
SCE SAFETY PROGRAM

1. Los Alamos National Laboratory (LANL), Lawrence Livermore National Laboratory (LLNL), the DOE Nevada Operations Office (DOE/NV) Performance-Based Management Contractor (PBMCM) and Security Services Contractor shall:
 - a. Have written procedures which ensure that:
 - (1) Delegation of responsibilities and authorities by name are clearly defined, recorded, and published for review by DOE/NV and available for review for all personnel participating in the SCE safety program.
 - (2) Organizational requirements, including those requirements imposed by and applicable to the U.S. Department of Energy (DOE) and DOE/NV safety orders, are clearly defined and communicated.
 - (3) All procedures for Subcritical Experiment Operations (SCEO) are completed, reviewed, and approved by the appropriate supervisor prior to execution of those activities.
 - b. Have a training and qualification program for their respective employees who perform SCEOs. This training program shall include:
 - (1) Requirements for selecting and qualifying personnel, including both physical and psychological fitness.
 - (2) Training consistent with the requirements of DOE Order 5480.20A, except Chapters II and III (Reactor Operations). Training and qualification requirements shall be commensurate with assigned duties.
 - c. Implement a SCE Personnel Assurance Program which follows those requirements stated in 10 Code of Federal Regulations, Part 711.
 - d. Implement the modified two-person concept as defined in paragraph 6h.
 - (1) LANL and LLNL shall evaluate their respective SCE operations and determine when the two-person concept shall apply.

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- (2) LANL and LLNL shall develop written procedures for the application of the two-person concept.
- (3) LANL and LLNL shall establish a list of personnel authorized for two-person control and shall ensure that the list be kept at the appropriate guard station and displayed at each SCE operational area.

2. LANL and LLNL shall:

- a. Ensure the accuracy of the SCE Safety Evaluation Panel (SEP) input data, including that provided by the DOE/NV PBMC and Security Service Contractor.
- b. Ensure the availability of necessary resources to support the SCE Safety Program.
- c. Prepare an input document and technical briefings for SEPs.
- d. Provide members and technical advisors to serve on the safety evaluation panels as requested by the DOE/NV Nuclear Explosive Safety (NES) Program Manager (PM). These persons shall be knowledgeable and shall not have direct design, development, or operational responsibility for the SCE operation to be evaluated. In addition, panel members are to be cognizant of DOE and DOE/NV Policies and Directives, and LANL and LLNL activities conducted at the Nevada Test Site (NTS).
- e. Prepare and submit approval requests to deviate from the approved operations as documented in the SEP Report and input documents.
- f. Prepare necessary documentation to ensure closure of SCE SEP recommendations and issues and shall ensure that the remaining operations will be conducted as reviewed and approved.

3. The DOE/NV PBMC and Security Services Contractor shall:

- a. Provide members and technical advisors to serve on the SEP as requested by the DOE/NV NES PM. These persons shall be knowledgeable and shall not have direct design, development, or operational responsibility for the SCE operation to be evaluated. In addition, panel members are to be cognizant of DOE and DOE/NV Policies and Directives, and LANL and LLNL activities conducted at the NTS.

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- b. Maintain and certify safety critical equipment used in SCEOs.

DOE NEVADA OPERATIONS OFFICE

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ELECTRICAL TESTER CRITERIA

MAY 1999

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SCE PROGRAM
ELECTRICAL TESTER CRITERIA

1. PURPOSE. This document establishes criteria that apply to the design, fabrication, control, calibration, operation, storage, modification, and approval of sensitive circuit test instruments used in conjunction with SCE assemblies and high explosives (HE). The criteria are consistent with the intent of DOE O 452.2, dealing with "Control of Electrical Testers/Equipment" (References a and b).
2. SCOPE. This criteria applies to sensitive circuit test instruments used on SCE. Sensitive circuit test instruments are used only for voltage; current and resistance measurements of HE; SCE; and nuclear explosive systems. Applicable sensitive circuit test instrument operations include nuclear explosive device and SCE assembly; detonator/squib firing; evaluations and investigations; routine cable and circuitry assessment; insertion; and pre-arming. The word "instrument" used in this document applies to sensitive circuit test instruments.
3. REQUIREMENTS.
 - a. The laboratory sponsoring the SCE shall retain the control and responsibility for the operation of those instruments subject to the criteria imposed by this document (References a and c).
 - b. Sensitive circuit test instruments shall:
 - (1) Be calibrated at least annually (Section 8: CALIBRATION/CERTIFICATION).
 - (2) Be given a preuse operational verification according to each test sponsoring laboratory's (TSL) procedures (Section 7: INSTRUMENT CONTROL, paragraph c).
 - (3) Be short circuit output current verified prior to each use in accordance with each TSL's procedures (Section 9: OPERATION, paragraph b).
 - c. Instruments designed for unique requirements shall consider all the criteria of this document and shall be evaluated on a case-by-case basis by TSL.

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- d. Electrical test/measuring instruments shall be assigned to types or classes on the basis of electrical characteristics that affect their safe use with HE systems or SCEs.
- e. Instrument categories shall be established so that each instrument type will be applied safely to one or more of the following classes of HE systems or SCE assemblies:
 - (1) Low Energy or Hot Wire Initiators. Any low energy actuator, cap, squib, initiator, or ignitor.
 - (2) High Energy Initiators. Any exploding bridge wire detonators, slapper detonators, or similar devices.
 - (3) Noninitiating Electrical Circuits. Sensitive control systems, mechanical system circuits, or auxiliary circuits used with HE and SCEs or components such as circuits connected to timing and firing (T&F) downhole cables including firing system component circuits, strain gages, pin switches, pressure transducers, thermocouples, or equivalent systems that attach to or are adjacent to any explosives.

4. DEFINITIONS.

- a. Instrument Types. Instruments are classified by their electrical characteristics. The types or classes segregate instruments into safe applications with HE systems or SCE assemblies. Administrative procedures and requirements related to each instrument type governing the instrument parameters including calibration, certification, control, storage, and operation are included as part of these utilization criteria.
- b. Instrument types are defined on the basis of the safe application of the instrument to HE and SCE assemblies:
 - (1) Type 1. Designed for use with low energy or hot wire initiators. The maximum design short circuit current is less than 10 milliamperes (ma).
 - (2) Type 2. Designed for use with high-energy initiators. The maximum design short circuit current is less than 100 ma.

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- (3) Type 3. Accepted for use with noninitiating electrical circuit applications such as T&F downhole cable measurements, including firing system component circuits. The maximum permissible design short circuit current exceeds that of Type 2 instruments.
- c. Calibration means to check, adjust, or systematically standardize the graduations of a quantitative measuring instrument.
- d. Certification means guaranteed in writing, vouched for, endorsed, or formally confirmed as true, accurate, genuine, or meeting a standard.
- e. Verification means determining, testing the truth, or accuracy of something by comparison, investigation, or reference.

5. INSTRUMENT DESIGN CRITERIA.

- a. Instruments will be designed such that a single component failure will not allow available current at the terminals to exceed the maximum design short circuit current limit for its classification. For an instrument to exceed its maximum design short circuit current, two independent component failures must occur. New and functionally modified Types 1 and 2 instruments will undergo a failure analysis that assesses both active and passive realistic failure modes and their results.
- b. Type 1 instruments must demonstrate during each calibration that their maximum design short circuit current output does not exceed 10 ma. Calibration verification of this current will be made using a calibrated, commercial test instrument certified by an approved standards calibration laboratory (SCL).
- c. Type 2 instruments must demonstrate during each calibration that their maximum design short circuit current output does not exceed 100 ma. Calibration verification of this current will be made using a calibrated, commercial testing instrument certified by an approved SCL.
- d. Type 3 instrument short circuit current exceeds that of Type 2 instruments.
- e. Types 1 and 2 instruments shall be designed such that their available short circuit current can be verified prior to each use.

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- f. The current-limiting features of an instrument shall be internal and shall not be dependent upon a fuse, a fuse-like device, or the characteristics of the test circuits.
 - g. Batteries supplying power to any instrument covered by this criteria shall be of minimum voltage. The voltage shall be no higher than necessary to perform the test functions.
 - h. Types 1 and 2 instruments shall be battery powered. Their test connections shall be verifiably incapacitated during any battery charging operation. A provision for battery containment or battery isolation shall be included in future designs if shown to be necessary by the failure analysis of paragraph 5a above.
 - i. An instrument shall not have, within itself, enough energy or combustible material to produce a fire in a malfunction. Self-extinguishing materials will be used wherever possible.
 - j. The cases of all instruments covered by these utilization criteria shall be dust resistant. Fixed instruments located in a closed room may be exempt from this requirement.
6. FABRICATION CRITERIA. Instrument fabrication shall comply with each TSL procurement and fabrication standards or those of the vendor, if the vendor's fabrication standards are acceptable to either TSL's Instrument Committee.
7. INSTRUMENT CONTROL.
- a. Only those instruments which have been evaluated by the Safety Evaluation Panel (SEP) are to be used on SCEs.
 - b. Instruments will be used by knowledgeable personnel, authorized by the TSL, to perform HE or nuclear explosive assembly work.
 - c. Each sensitive circuit test instrument shall receive a preuse operational verification prior to SCE assembly use. The preuse verification process will evaluate the functionality of the instrument. Normally this verification is done once for each event according to the TSL's procedures. A Personal Assurance Program (PAP) authorized person of the TSL shall check and reverify the

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instrument condition, seals, and output current of each instrument to be used. The preuse verification may be performed at a storage or field location and shall be documented.

- d. After verification, instruments shall be kept under strict administrative and physical control by authorized, PAP-certified personnel. Strict administrative and physical control shall be maintained from the time each certified instrument is removed from storage and verified for use until it is returned to storage.

8. CALIBRATION/CERTIFICATION.

- a. Each instrument covered by this criteria is checked at least annually for current limiting features (i.e., short circuit current) and functional capability. The calibration is performed using standards that:
 - (1) Are traceable to the National Bureau of Standards or equivalent; and
 - (2) Meet the calibration policies and procedures of the SCL and are accepted by the TSL.
- b. The TSL will authorize a SCL in accordance with these utilization criteria to repair, test, calibrate, and certify sensitive circuit test instruments.
- c. SCL personnel will be knowledgeable and authorized by their organization for instrument service in accordance with policies and procedures accepted by the TSL.
- d. At the time of initial instrument calibration and certification, the SCL will perform and document a comprehensive wiring check (point-to-point, if possible) to ensure accuracy of the instrument components. At the time of each subsequent instrument calibration and certification, insofar as practicable (i.e., little or no impact on the reliability of the instrument), the SCL will perform and document the extent of a wiring check to ensure accuracy of the instrument components.
- e. Documented short circuit current tests shall be performed during the initial instrument certification and during each subsequent calibration to ensure that the maximum allowable short circuit current for its class is not exceeded. See 5a, b, c, and d above.

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- f. Antitamper seals will be placed on the test instrument after initial certification and at each subsequent calibration or repair. If any antitamper seal is broken or removed, the test instrument will be returned to the SCL and recertified in accordance with the procedures described above. It shall not be used on an SCE assembly prior to recertification.
- g. A certification sheet will be maintained for each test instrument. This certification sheet will list all operation and test results performed by the authorized standards calibration organization. It will provide a tabulation of the results for comparison. The sheet will be completed at each instrument certification. In addition, a sticker with the latest calibration and certification date, the next calibration date, and the inspector's initials will be attached to the test instrument.
- h. The instrument calibration, certification, and verification sheets will be maintained by the TSL for easy inspection. Any instrument returned for repair shall be recalibrated, recertified, and reverified prior to use.

9. OPERATION.

- a. Operations are controlled by TSL operational requirements, procedures, checklists, and shall be in compliance with all applicable requirements, including DOE and DOE/NV Orders and the U.S. Department of Energy Explosive Safety Manual (Reference d).
- b. Each TSL checklist(s) shall include a short circuit current measurement to verify the current limiting feature of the meters. This short circuit current verification shall be made prior to using the instrument on a HE or SCE assembly. Two PAP-certified personnel of the TSL will participate in this verification.
- c. Any instrument that fails a short circuit test shall:
 - (1) Not be used for the task in progress. A certified replacement will be obtained;
 - (2) Not be returned to service without thorough evaluation to determine the reason for failure of the current limiting components; and
 - (3) Be repaired, recalibrated, and recertified by the authorized SCL.

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10. STORAGE.

Certified instruments covered by this criteria shall be stored in locked combination safes or under strict administrative control prior to short circuit current verification. Safe combination(s), when applicable, will be known only by authorized PAP-certified personnel.

Control of instruments removed from storage shall comply with paragraphs 7, 8, and 9 above.

11. APPROVAL OF NEW INSTRUMENTS AND MODIFICATION OF CURRENTLY APPROVED INSTRUMENTS.

- a. New sensitive circuit test instruments that do not meet the required design parameters and functionally modified instruments may be approved for use upon completion of the assessments required by the TSL Instrument Evaluation Committee and found acceptable in an approved SEP evaluation.
- b. No instrument endorsed for use by a TSL-approved study or SCE related study may be functionally modified and used for any application associated with an SCE without the assessment required by this criteria and reviewed in an approved SEP evaluation.

12. REFERENCES.

- a. DOE O 452.2A, SAFETY OF NUCLEAR EXPLOSIVE OPERATIONS, dated 1-17-97.
- b. LANL Group J-8 Directive DIR-J8-01, Group J-8 Directive, Electrical Instruments for Use with Explosive Systems.
- c. NV Order 5610.11A, NUCLEAR EXPLOSIVE SAFETY (NES) PROGRAM, dated 11-12-93, and Changes thereto.
- d. DOE M 440.1-1 EXPLOSIVES SAFETY MANUAL, dated 9-30-95.

**DOE NEVADA OPERATIONS OFFICE (DOE/NV) NUCLEAR EXPLOSIVE SAFETY
(NES)/SCE CHANGE CONTROL PROCESS**

NES CHANGE CONTROL PROCESS.

This section establishes the nuclear explosive (NE) safety change control process at the Nevada Test Site by defining the screening method and appropriate approval level for changes. Part of the authorization basis for conducting an NE operation is the approval, by the DOE/NV Manager and DOE Headquarters, of the Nuclear Explosive Safety Study Group (NESSG) report. The DOE/NV NES Change Control Process allows the design laboratories the flexibility needed to conduct day-to-day operations efficiently and still maintain the appropriate safety focus.

A proposed change to any NE or associated facility shall be screened and appropriately documented to ensure that there are no direct or secondary safety effects. The process functions as follows:

1. The first level of laboratory line management may approve those changes that are trivial or strictly administrative in nature with no likelihood of significance to NES. These changes require no further NES evaluation.
2. If the proposed change has the potential for impacting safety, it shall be presented to the Test Director (who acts as an agent for the Manager, DOE/NV) for review, and having been involved in and being familiar with the U.S. Department of Energy (DOE)-approved NESSG report, decides if the change is acceptable within the framework of the approved report, or if the proposed change must be forwarded to DOE for further review.
3. If the Test Director determines that the proposed change falls outside the framework of the approved report impacting the safety of the approved operations, it shall be brought to the attention of the DOE/NV NES Program Manager (PM). Changes submitted to the DOE/NV NES PM for review shall be documented sufficiently that a logical and reasonable decision can be reached. The DOE/NV NES PM shall determine the appropriate change approval mechanism (e.g., administrative approval or NES study).